



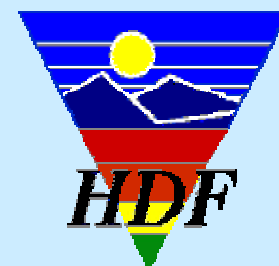
# *The Goddard DAAC*

<http://daac.gsfc.nasa.gov>

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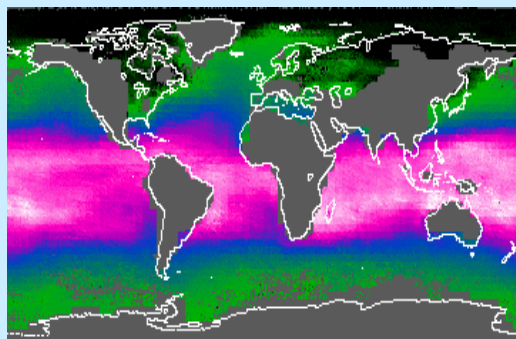
## *HDF and HDF-EOS Experiences and Applications*



Presented by:  
James Johnson,  
SSAI

# Science Disciplines

## Atmospheric Dynamics



TOVS 1000 hPa Monthly Mean Specific Humidity

- TOVS Pathfinder
- **Data Assimilation**
- **Terra MODIS**
- Aqua AIRS
- Aqua MODIS

Black  
-  
completed

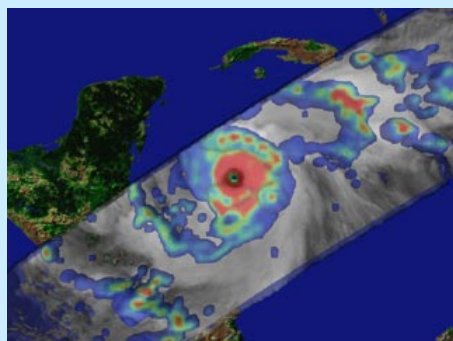
Red

- active

Green

- future

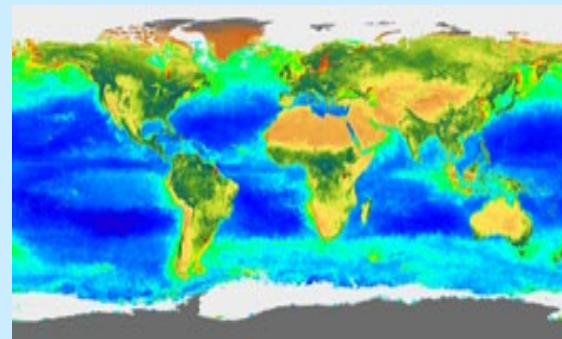
## Hydrology



Hurricane Mitch as seen by TRMM

- Rainfall Climatology
- **TRMM**
- **TRMM Field Experiments**
- Aqua AIRS

## Global Biosphere



Monthly Ocean Chlorophyll and NVDI from SeaWiFS

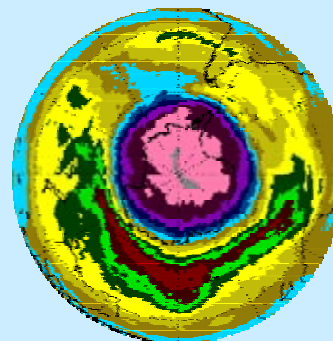
### Ocean Color

- CZCS
- OCTS
- **SeaWiFS**
- **Terra MODIS**
- Aqua MODIS

### Land Biosphere

- **AVHRR Pathfinder**

## Upper Atmosphere



1999 Antarctic Ozone Hole as seen by TOMS

- Heritage BUV/SBUV
- Heritage LIMS
- Heritage TOMS
- UARS
- **EP TOMS**
- Aqua HIRDLS
- Aqua MLS
- Aqua OMI
- **SORCE**



# *Primary Data Sets*

<b>Data Set</b>	<b>Format</b>	<b>Temporal Coverage</b>
<b>AVHRR Pathfinder</b>	HDF (subsets in binary)	Jul 1981 to Oct 2001
<b>CZCS</b>	Binary	Oct 1978 to Jun 1986
<b>DAO</b>	Binary	Mar 1980 to Nov 1993
<b>MODIS (Terra)</b>	HDF-EOS	Dec 1999 to Present
<b>SeaWiFS</b>	HDF	Dec 1996 to Present
<b>TOMS</b>	HDF	Nov 1978 to Present
<b>TOVS Pathfinder</b>	HDF (subsets in binary)	Nov 1978 to Jul 1995
<b>TRMM</b>	HDF	Dec 1997 to Present
<b>UARS</b>	Binary	Sep 1991 to Sep 2001
<b><i>DAS</i></b>	<i>HDF-EOS</i>	<i>(soon)</i>
<b><i>AIRS</i></b>	<i>HDF-EOS</i>	<i>Mar 2002 (launch)</i>
<b><i>Aura</i></b>	<i>HDF5-EOS</i>	<i>Jul 2003 (launch)</i>
<b><i>SORCE</i></b>	<i>HDF5</i>	<i>Jul 2002 (launch)</i>



# *HDF & HDF-EOS Applications*

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- Universal Data Reduction Server (UDRS)
  - ◆ Distributed Oceanographic Data System (DODS)
  - ◆ Web Mapping Testbed (WMT-DODS)/OpenGIS
  - ◆ Live Access Server (LAS)/Ferret
  - ◆ Gridded Analysis and Display System (GrADS-DODS)
- Online data Analysis (OASIS)
- read\_hdf generic reader
- other data set specific read software, including MODIS



# *Universal Data Reduction Server*

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- A virtual server consisting of:
  - ◆ DODS server
  - ◆ WMT-DODS server
  - ◆ GrADS-DODS server
  - ◆ LAS/Ferret
  - ◆ (others can be added)
- Allows a variety of discipline, interdisciplinary and applications users to access DAAC data



# Distributed Oceanographic Data Server

DODS Dataset Query Form - Mozilla (Build ID: 2000070400)

File Edit View Search Go Bookmarks Tasks Help Debug QA

Back Forward Reload Stop 2000/02/TOMSEP\_DAILY\_000218+HDF.Z.html Search Post

Home Bookmarks Internet Message WebMail People Yellow Pages Download New & Cool Channel

## DODS Dataset Access Form

Tested on Netscape 4.01 and Internet Explorer 3.00

**Actions:**

**Data URL:** <http://eosdata.gsfc.nasa.gov/daac-bin/np4-hdf/DODS/toms/ep/2000/02/TOMSEP>

**Global Attributes:**

```

SDS_SHORT: "TOMS TOMS-EP DAILY GLOBAL STRIPPED DATA 02_00_00",
"data_set": TOMS11\012\data_product+Level 3 daily gridded
\data1\012\geosmile_s1a+222746\012\begin_date+2000-02-28
001001001\012\end_date+2000-03-28
231591591\012\geog_flag+0\012\swath_lat+76.00\012\swath_lat+90.00\
e]
  
```

**Variables:**

☒ **TOTAL OZONE:** Grid

LATITUDE: 47154 LONGITUDE: 79186

```

scale_factor: 1
scale_factor_err: 0
add_offset: 0
add_offset_err: 0
calibrated_s1: 22
long_name: "TOTAL OZONE"
  
```

☐ **REFLECTIVITY:** Grid

LATITUDE: LONGITUDE:

```

scale_factor: 1
scale_factor_err: 0
add_offset: 0
add_offset_err: 0
calibrated_s1: 22
long_name: "REFLECTIVITY"
  
```

Send questions or comments to: [np4support@eosdata.nasa.gov](mailto:np4support@eosdata.nasa.gov)

Enter start, stride and stop for the array dimension.

- DODS developed by URI and UCAR
- a **protocol** for requesting and transporting data across the web
- Transparently supports multiple formats
- Subsetting performed at server end
- Supports various servers (netCDF, HDF, GrADS, MatLAB, FreeForm,...)
- Supports various clients (IDL, MatLAB, Ferret, LAS, GrADS, ...)
- Various DAAC data sets served by DODS

(see [http://daac.gsfc.nasa.gov/DAAC\\_DOCS/DODS.html](http://daac.gsfc.nasa.gov/DAAC_DOCS/DODS.html))

```

$occur: TOMS11\012\data_product+Level 3 daily gridded
TOTAL_OZONE.LONGITUDE: 76.075, 76.025, 76.075, 76.125, 76.075, 76.025, 76.075, 76.125, 76.075, 76.025
TOTAL_OZONE.TOTAL_OZONE(TOTAL_OZONE.LATITUDE=40.5): 245. 270. 271. 283. 283. 286. 277. 281. 226. 200
TOTAL_OZONE.TOTAL_OZONE(TOTAL_OZONE.LATITUDE=40.5): 251. 257. 270. 285. 285. 289. 276. 246. 214. 209
TOTAL_OZONE.TOTAL_OZONE(TOTAL_OZONE.LATITUDE=40.5): 235. 255. 249. 274. 275. 274. 274. 285. 219. 211
TOTAL_OZONE.TOTAL_OZONE(TOTAL_OZONE.LATITUDE=40.5): 219. 246. 244. 270. 263. 243. 244. 219. 216. 211
TOTAL_OZONE.TOTAL_OZONE(TOTAL_OZONE.LATITUDE=39.5): 215. 237. 242. 260. 254. 254. 260. 232. 217. 204
TOTAL_OZONE.TOTAL_OZONE(TOTAL_OZONE.LATITUDE=39.5): 204. 211. 222. 228. 227. 240. 235. 221. 204. 200
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TOTAL_OZONE.TOTAL_OZONE(TOTAL_OZONE.LATITUDE=34.5): 204. 253. 249. 264. 262. 264. 215. 204. 202. 200
TOTAL_OZONE.TOTAL_OZONE(TOTAL_OZONE.LATITUDE=34.5): 200. 261. 261. 264. 262. 266. 208. 205. 202. 201
  
```





# Web Mapping Testbed WMT-DODS Server

- OpenGIS consortium
- Import HDF & HDF-EOS data into GIS packages
- Supports geolocated images
- Interface to many DODS servers
  - ◆ DAAC
  - ◆ external

(see <http://daac.gsfc.nasa.gov/daac-bin/viewer/viewer.cgi>)





# *GrADS-DODS Server*

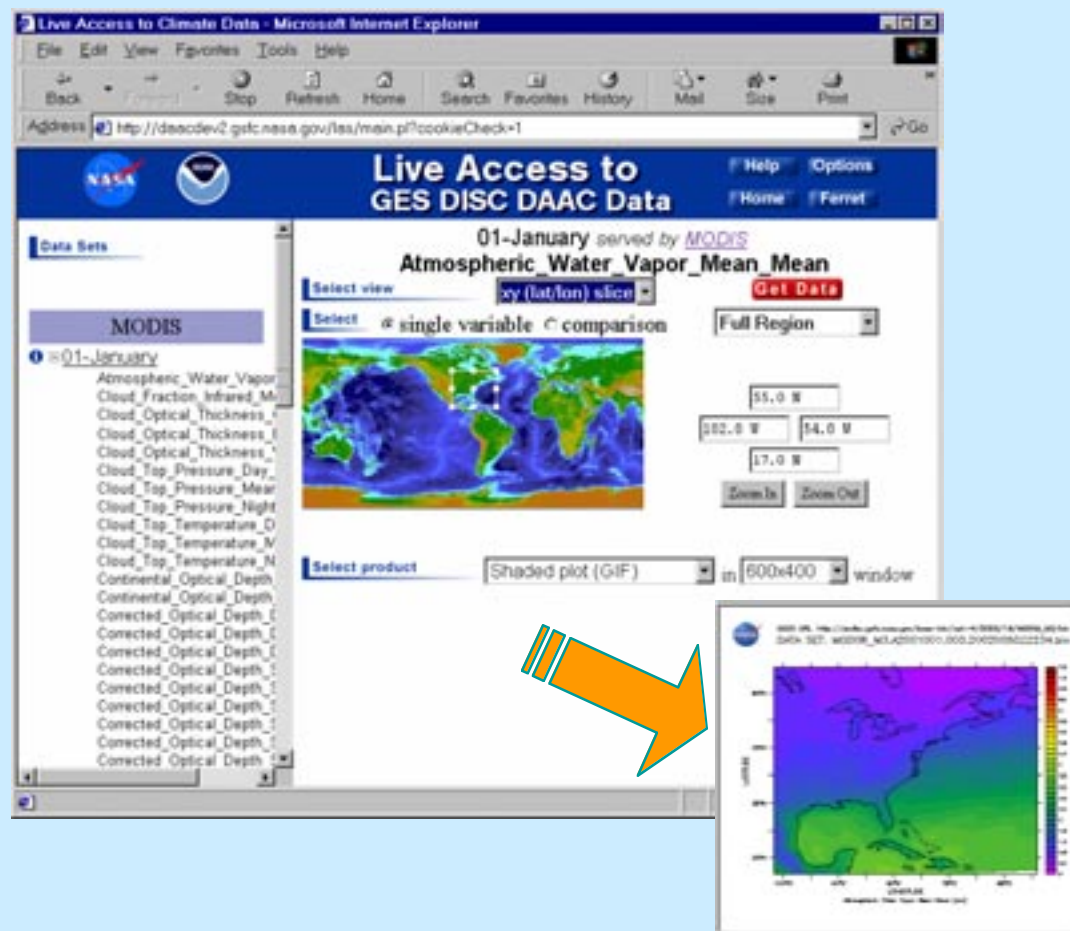
- Developed by Center for Ocean-Land-Atmosphere Studies (COLA)
- Supports data analysis functions (statistical, smoothing, correlation, ...)
- Subset data
- Work on single or multiple files
- Supports several data formats (HDF, netCDF, GRIB, binary, ...)
- Interfaces with DODS
- DAAC Server to go operational later this year





# Live Access Server/ Ferret

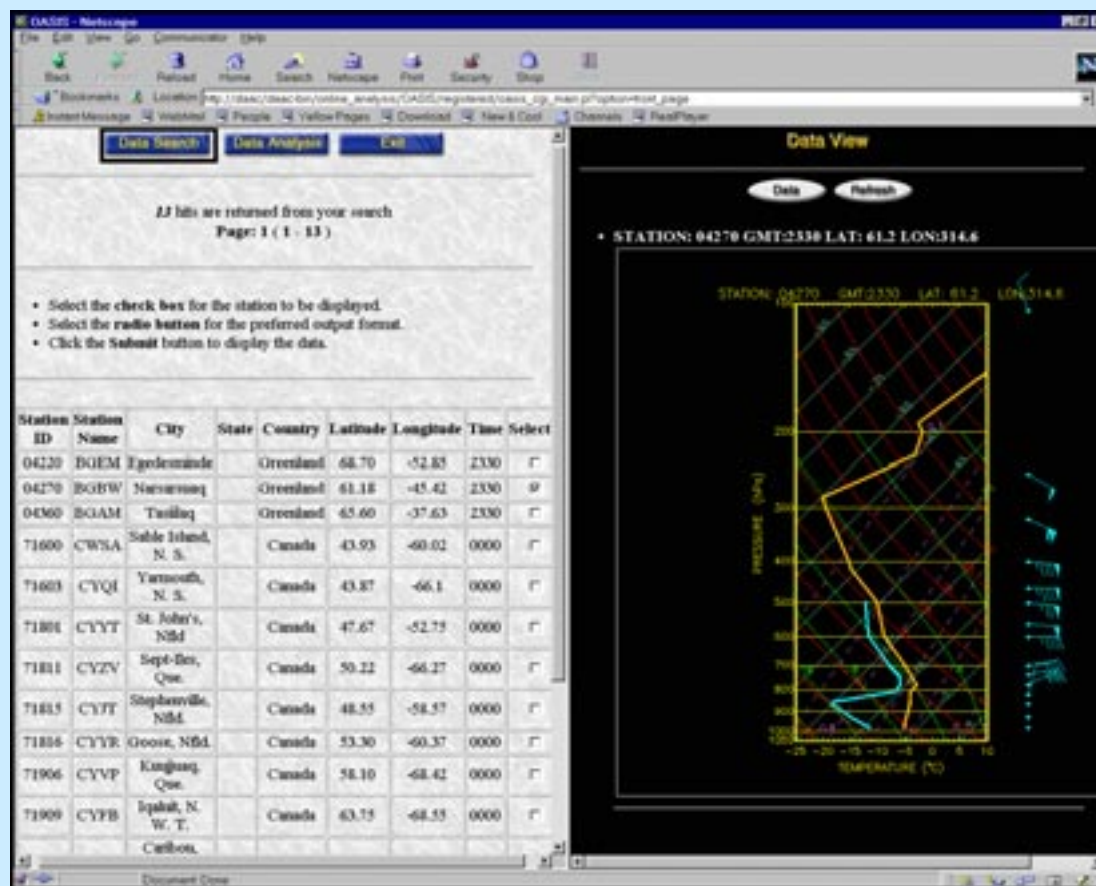
- LAS developed by NOAA
- Web GUI interface (Ferret)
- Interfaces with DODS
- Visualize data
- Subset data
- Save to various formats
- Custom data set specific templates added by DAAC
- Support for MODIS and SeaWiFS (coming soon)





# Atmospheric Dynamics OASIS

- Web Interface
- Uses JAVA applets
- Perform data analysis online
- Intercomparison
- Visualize data
- Animations
- Supports DAAC atmospheric dynamics data
- HDF & HDF-EOS support coming soon



(see [http://daac.gsfc.nasa.gov/CAMPAIGN\\_DOCS/atmospheric\\_dynamics/online\\_analysis/OASIS/html/](http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/atmospheric_dynamics/online_analysis/OASIS/html/))



# *read\_hdf*

- Interactive command line C program
- Generic, supports any HDF file
- Display hierarchical tree of useful objects (SDS, Vdata, Vgroup, Raster Images, Annotations)
- Subset data
- Output to ASCII or binary
- Also dump any obscure HDF object (DFTAG\_NT, DFTAG\_VERSION, etc.)



# *Other DAAC HDF Applications*

- MODIS readers and visualization (IDL based)  
(see [http://daac.gsfc.nasa.gov/CAMPAIGN\\_DOCS/MODIS/](http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/MODIS/))
  - ◆ geoview
  - ◆ modis\_atmos
  - ◆ simap
  - ◆ HDFLook-MODIS (collaboration between DAAC and the Laboratoire d'Optique Atmosphérique, France)
- SeaWiFS data best used with SeaWiFS' SeaDAS package
- TRMM data reader and IDL based TSDIS orbit viewer
- Other DAAC data sets include C, Fortran and/or IDL readers



# ***HDF & HDF-EOS Issues***

- **Large file sizes (MODIS, AVHRR)**
  - ◆ requires lots of bandwidth for downloading
  - ◆ end user needs lots of disk space
  - ◆ non-standard Grid projections
- **User frustration**
  - ◆ reluctance to accept HDF (prefer ASCII, binary, other formats)
  - ◆ download and install libraries (two for HDF-EOS)
  - ◆ confusion - HDF, HDF-EOS, and now HDF5
- **Poor HDF layout/implementation (or not self documenting)**
  - ◆ cryptic field and file names
  - ◆ no field level attributes or descriptions of file contents
  - ◆ too many fields
  - ◆ internal compression rarely utilized